

CLAIMS

What is claimed is:

- 1 1. A system for detecting underwater buried objects comprising:
2 an acoustical camera adapted to produce three dimensional volumetric images of an
3 underwater target area volume of an underwater floor;
4 an acoustic transducer adapted to apply an acoustic pulse to the target area volume
5 so as to cause displacement of materials included in the target area volume;
6 and
7 a controller adapted to coordinate operation of the camera and the acoustic
8 transducer, wherein a first volumetric image of the target area volume is
9 produced before the acoustic pulse is applied, and a second volumetric
10 image of the target area volume is produced while the acoustic pulse is
11 present in the target area volume.
- 1 2. The system of claim 1 wherein the camera produces volumetric images of
2 the underwater target area volume at a real-time frame rate.
- 1 3. The system of claim 1 wherein the camera is further adapted to operate in
2 an interferometer mode having a resolution of less than one wavelength.
- 1 4. The system of claim 1 wherein the controller is further adapted to compare
2 volumetric images for evidence of at least one of a partially or completely buried object.
- 1 5. The system of claim 4 wherein the evidence of buried objects is based on
2 movement of floor materials relative to the buried objects.
- 1 6. The system of claim 1 further comprising:
2 an image recorder adapted to record the volumetric images.
- 1 7. The system of claim 1 wherein the acoustical transducer is extendible
2 towards the target area volume.
- 1 8. The system of claim 1 further comprising:

2 an image discrimination module adapted to discriminate interesting objects from
3 non-interesting objects detected in the volumetric images.

1 9. The system of claim 1 further comprising:

2 a range finder adapted to detect when the system is at a proper distance from the
3 target area volume for imaging purposes.

1 10. The system of claim 1 wherein the camera is configured for producing
2 volumetric images within a 16 feet range at a frame rate greater than 10 frames/second, the
3 camera having an acoustical lens configured for forming images on an array of acoustical
4 transducer elements.

1 11. A system for detecting underwater buried objects comprising:

2 an acoustical camera adapted to produce three dimensional volumetric images of an
3 underwater target area volume of an underwater floor;

4 an acoustic transducer adapted to apply an acoustic pulse to the target area volume
5 so as to cause displacement of materials included in the target area volume;

6 and

7 a controller adapted to coordinate operation of the camera and the acoustic
8 transducer, so that a volumetric image of the target area volume is produced
9 while the acoustic pulse is present in the target area volume, thereby
10 allowing buried objects to be detected based on relative movements in the
11 target volume area.

1 12. The system of claim 11 wherein the camera is further adapted to operate as
2 an acoustical imaging interferometer having a resolution of less than one wavelength.

1 13. A method for detecting underwater buried objects comprising:

2 producing one or more three dimensional volumetric images of an underwater
3 target area volume of an underwater floor;

4 applying an acoustic pulse to the target area volume so as to cause displacement of
5 materials included in the target area volume; and

6 producing one or more second volumetric images of the target area volume while
7 the acoustic pulse is present in the target area volume.

1 14. The method of claim 13 wherein producing volumetric images of the
2 underwater target area volume is performed at a real-time frame rate.

1 15. The method of claim 13 wherein producing volumetric images of the
2 underwater target area volume is performed using a resolution of less than one wavelength.

1 16. The method of claim 13, further comprising:
2 comparing volumetric images for evidence of at least one of a partially or
3 completely buried object.

1 17. The method of claim 16 wherein comparing volumetric images for evidence
2 of buried objects includes detecting movement of floor materials relative to the buried
3 objects.

1 18. The method of claim 13 further comprising:
2 recording the volumetric images.

1 19. The method of claim 13 further comprising:
2 discriminating interesting objects from non-interesting objects detected in the
3 volumetric images.

1 20. The method of claim 13 further comprising:
2 detecting a proper distance from the target area volume for imaging purposes.